Apr 77

# SWAP

## STEWART-WARNER ARRAY PROGRAMMING

SYMBOL OF

SW

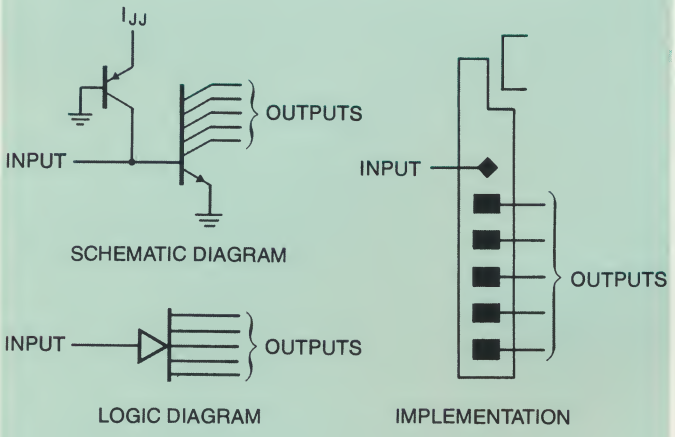
EXCELLENCE

STEWART-WARNER MICROCIRCUITS DIVISION

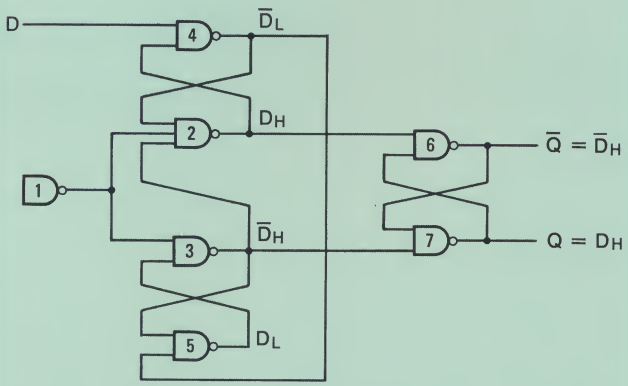
STEWART-WARNER CORPORATION

# What is SWAP

**I²L Gate**

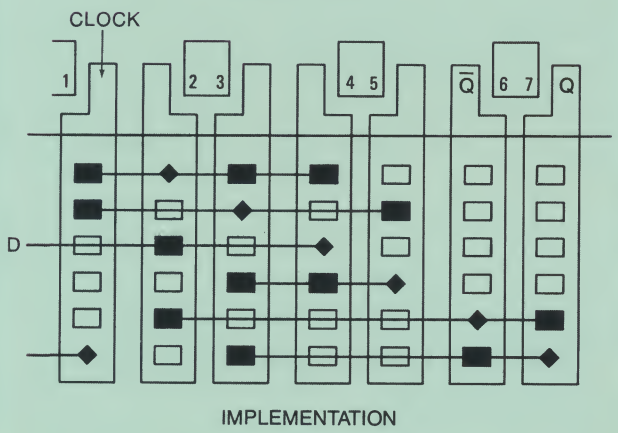



**I²L D Flip-Flop**




| $D_n$ | $Q^{n+1}$ |
|---|---|
| 0 | 0 |
| 1 | 1 |

TRUTH TABLE




The Stewart-Warner Array Program (SWAP) is a new approach to digital system design. SWAP allows the designer to specify his own LSI logic at the chip level, gaining all the advantages of an LSI custom design without the very expensive costs and long run production commitments previously required.

The essence of SWAP is Integrated Injection Logic (I²L). This unique logic form uses a single type of structure throughout and requires just one of those structures to form a logic gate. Each of the basic logic elements in a SWAP I²L Array will perform all of the digital functions of a multiple input NAND gate. The gates can be interconnected to perform any of the more complex logic functions such as flip flops, registers, counters, Schmitt-triggers, multivibrators, etc., in addition to various random gating functions.

Stewart-Warner I²L logic elements are completely processed up to the point of final metalization. The interconnection pattern for this uncommitted logic array is defined by the customer to his specialized system requirements. Layout of the final metalization pattern is simpler than for a PC board. By combining the high density I²L technology and a pre-processed standard logic array, SWAP offers you the multiple advantage of an LSI custom circuit without the expensive and time-consuming development cycle.

With a SWAP die you get all the benefits of a custom integrated circuit—at mass production prices. Printed circuit card costs are reduced. Types of components kept in inventory are fewer. Troubleshooting time and failure rates are down.

Switching speeds of the SWAP gates is a direct function of the injection current provided to the structure. This current may be varied from a few microamps to 100 microamps per gate depending on system requirements. Since the SWAP gate array operates at approximately 0.75 volts, power consumption is extremely low on a per gate basis, and is dependent only on the propagation delays required. Large numbers of gates can be put on a single die without heat dissipation problems.

Stewart-Warner believes that I²L is the long sought after "Digital Master Slice." The master slice need only contain an array of I²L gates, enough "dive unders" to assure versatility of interconnection possibilities, and suitable input/output circuits for interfacing with other logic forms or discrete components.

Two basic SWAP Arrays are available:

| DESIGNATION | NUMBER OF GATES | NUMBER OF DIVE UNDERS | PACKAGE |
|---|---|---|---|
| SWAP-16 | 208 | >200 | Dual in line 16 pin |
| SWAP 24 | 408 | >400 | Dual in line 24 pin |

Provided on each of the above arrays are input/output structures for each device lead. These structures permit conversion between any standard logic (TTL, DTL, C/MOS, etc.) and SWAP. The injection current can also be programmed by "on chip" resistors allowing standard TTL, DTL, or C/MOS power supplies to be used with SWAP.

## HOW TO USE SWAP—THE DESIGN MANUAL

One of the major goals of the SWAP concept is to permit the customer to do most of the logic design and the layout of the metalization interconnect pattern. His knowledge of his system requirements supplies an important insight into the optimization of the trade-offs involved. The SWAP design manual explains the details of the basic $I^2L$ chips and guides the designer through the comparatively simple procedures necessary to complete his custom design.

Work sheet vellums for both the SWAP-16 and SWAP-24 die and 15 pre-packaged sample devices are furnished with the design manual. The sample devices assist the designer to gain familiarity with $I^2L$ logic. They include seven sample gate packages, five "D" flip flop circuits, one output interface, one input interface, two types of oscillators, two $I^2L$ pulse shapers, a Schmitt-trigger, and a monostable multivibrator using the I/O transistors. (These sample devices are intended for logic verification only and are not suitable for high speed operation or operation over extended temperature ranges.)

There are three basic ways to use SWAP:

| PACKAGE | DEVELOPMENT PLAN | | |
|---|---|---|---|
| | A | B | C |
| 16 Leads | $3,800 | TBN* | $1,800 |
| 24 Leads | 4,350 | TBN* | 2,050 |

*To be negotiated

## DEVELOPMENT PLAN A

In this plan our customer designs the die and we review the design. When there is mutual agreement that the design is acceptable, we assume responsibility for the design and proceed to ship 25 tested prototypes.

## DEVELOPMENT PLAN B

Plan B is for customers who do not have experienced digital circuit designers available. We take on the entire design task and supply 25 tested prototypes. These development charges are to be negotiated.

## DEVELOPMENT PLAN C

Under Plan C our customer generates his interconnection diagram and we build and ship 25 prototypes without reviewing the design or testing the prototypes.

## COSTS

Standard development costs for SWAP if customer does layout of circuits vary from as low as $1,800 up to $4,350. If customer elects to have Stewart-Warner Microcircuits do the layout, then price for development is to be negotiated per Plan B. Production pricing is listed in the next column.

The Design Manual including working vellums and kit of $I^2L$ circuits is available for $25.

## PRODUCTION QUANTITIES PRICE LIST

| **SWAP-16**<br>16 LEADS<br>208 GATES<br>QUANTITY | PLASTIC D.I.P.<br>0°C TO 70°C<br>BASE PRICE | GATE PRICE |
|---|---|---|
| 100- 499 | $ 4.32 | $ .03139 |
| 500- 999 | 2.45 | .01769 |
| 1,000- 2,499 | 1.31 | .00947 |
| 2,500- 4,999 | .89 | .00649 |
| 5,000- 9,999 | .77 | .00558 |
| 10,000-24,999 | .68 | .00490 |
| 25,000-49,999 | .61 | .00437 |
| 50,000- | .54 | .00399 |

| **SWAP-24**<br>24 LEADS<br>408 GATES<br>QUANTITY | PLASTIC D.I.P.<br>0°C TO 70°C<br>BASE PRICE | GATE PRICE |
|---|---|---|
| 100- 499 | $ 10.23 | $ .05030 |
| 500- 999 | 5.79 | .02838 |
| 1,000- 2,499 | 3.09 | .01519 |
| 2,500- 4,999 | 2.11 | .01037 |
| 5,000- 9,999 | 1.82 | .00896 |
| 10,000-24,999 | 1.60 | .00789 |
| 25,000-49,999 | 1.43 | .00702 |
| 50,000- | 1.29 | .00633 |

Price List Effective thru June 30, 1977

The unit price for a SWAP circuit is determined by the number of gates used by the designer. The maximum number of gates on SWAP-16 is 208; the maximum number of gates on SWAP-24 is 408. For a given quantity, in a specified package, there is a fixed base price plus a price for each gate used. To determine the unit price of a circuit, follow these steps:

Step 1: Find the base price on the line with the desired quantity level.

Step 2: Next to the base price is the unit gate price which you will multiply by the number of gates used in your design.

Step 3: Add the result of step 2 to step 1. This is your unit device price that you will pay for each circuit.

Example: An order for 11,000 SWAP-16 circuits in plastic using 150 gates each:

| | |
|---|---|
| Base Price | $0.680 |
| Gate Price—150 × .00400 | 0.735 |
| Total Price per Circuit | $1.415 |

Note: Production unit prices subject to Stewart-Warner Microcircuits acceptance of customer test specifications.

# SWAP
## CUSTOM DESIGNED LOGIC SYSTEMS AT MASS PRODUCTION PRICES

## ADVANTAGES OF SWAP:

**Lower procurement costs**

on a gate for gate basis SWAP will cut your gate price by at least 50%

**Lower manufacturing costs**

one or two SWAP LSI circuits can replace up to 50 to 100 gates and MSI functions

**Lower development costs**

you can develop your own proprietary LSI custom array for 10-20% of previous development costs

**Lower power requirements**

a few microwatts to 80 microwatts per gate commensurate with your speed requirements

**Higher reliability**

fewer devices, fewer insertions, and fewer interconnections

**Fastest turnaround for custom LSI**

since SWAP is totally processed prior to commitment to a new design, turnaround time of approx. 4 weeks is all that is required to customize your logic

**Smaller system size and costs**

since 1 or 2 SWAPS will replace up to 50 to 100 standard packages, the PC board, power supplies and hardware are reduced in size and cost

**Greater efficiency**

reduced inventory control, procurement activity and simplified documentation

**Versatility**

fully compatible with TTL, DTL, and C/MOS logic levels and power supplies

SYMBOL OF EXCELLENCE
STEWART-WARNER MICROCIRCUITS DIVISION
STEWART-WARNER CORPORATION

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Phone: (408) 245-9200 • TWX: 910-339-9210

Put stamp here.
The Post Office will
not deliver mail
without postage.

STEWART-WARNER MICROCIRCUITS
730 EAST EVELYN AVENUE
SUNNYVALE, CALIFORNIA 94086

MARKETING DEPARTMENT

Tear along this line.

FOR YOUR
CONVENIENCE
USE THIS
ORDER FORM

GENTLEMEN:

Please rush me your $25.00 SWAP Design Kit, which includes:

a. SWAP Design Manual.
b. Work sheet vellums for both the SWAP-16 and SWAP-24 die.
c. Fifteen (15) pre-packaged sample devices.

Enclosed is check/Purchase Order No. _____ for _____ at $25.00 each.

(When paying by check, please use an envelope. Address envelope as shown on reverse side.)

NAME _____ MAIL STOP # OR DEPT. _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

TELEPHONE: _____

☐ I need more information. Please have a representative call me.

Tear along this line.

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